Chem-Nuclear Site
ANNUAL UPDATE
2008

S.C. Department of Health and Environmental Control • Bureau of Land and Waste Management • Fall 2008

Introduction ...

In October 2007, the S.C. Deparment of Health and Environmental Control (DHEC) held a community meeting about the Chem-Nuclear Site.

During that meeting, DHEC staff agreed to provide annual updates about the contaminated groundwater monitoring and other activities at the site. This newsletter and upcoming community meeting are part of that effort to keep the community informed.

For more information, you are encouraged to attend the next community meeting at the S.C. Advanced Technology Park,1321 Technology Drive in Snelling on Thursday, November 6. The meeting will begin at 7 p.m. DHEC staff will be available to answer your questions.

Inside ...

Groundwater Plume

Just what is a groundwater plume? A plume is an area where contaminants, such as tritium (a radioactive form of hydrogen), move along in groundwater.

DHEC looks at groundwater data from 182 locations in and around the Chem-Nuclear Site including monitoring wells and surface water in Mary's Branch Creek. This data helps DHEC track the plume that is leaving the disposal site.

The tritium plume at Chem-Nuclear Site was formed when tritium from waste packages made its way into the groundwater beneath the trenches. The highest levels of tritium are found in the plume near the oldest trenches (1970s) where disposal practices were less advanced than those used later. Groundwater travels vertically downward from the trenches. The downward travel time is about 10 years. Upon entering a sandy zone, groundwater travels horizontally until it enters the creek. The horizontal travel time is about an additional 10 years.

What are VOCs?

Volatile organic compounds (VOCs) are a group of commonly used chemicals that evaporate when exposed to air. Since they dissolve or break apart many other substances, VOCs are widely used to clean things. They are used in fuels, degreasers, polishes, cosmetics, drugs and dry cleaning solutions.

Which VOCs were disposed of at the Chem-Nuclear Site?

It is known that VOCs were disposed of at the Chem-Nuclear Site. VOCs were commonly used in commercial and academic laboratories to find out how much radioactivity was in a sample. The waste associated with the laboratory work was mostly radioactive, but it also contained some VOCs and was sometimes sent to the Chem-Nuclear Site for disposal. Other potentially hazardous chemicals may have been disposed before there were regulations (or rules) against such disposal. Since there were no regulations at the time, records were not kept about which chemicals and how much of the chemicals were disposed. Therefore, VOCs may have been disposed of at the site as early as 1971 when operations began until 1979 when they were banned due to new rules.

2008 Update

Tritium in the Groundwater Plume

The map on page 2 shows the concentrations of tritium found in wells on and off site. These results are from the most recent samples collected during the second quarter of 2008 (April to June 2008). The highest concentration of tritium continues to be found on site at well location WM-0110 where it was 18,303,000 pCi/L. The concentration where the plume enters the creek (WC-0002) was 425,000pCi/L. The concentration at the "point of compliance" was 88,918 pCi/L.

*Continued, see **Plume** on the following page*

Plume, *continued from page 1*

The "point of compliance" is considered to be the point where regulatory limits apply. In this case, it is where the creek flows off of Chem-Nuclear property and onto Savannah River Site property. The levels of tritium are not allowed to exceed 500,000 pCi/L at the point of compliance. The recent levels of tritium do not exceed 500,000 pCi/L and are within regulatory limits. Water from the monitoring wells and creek cannot be used as a source of drinking water.

VOCs in the Groundwater Plume

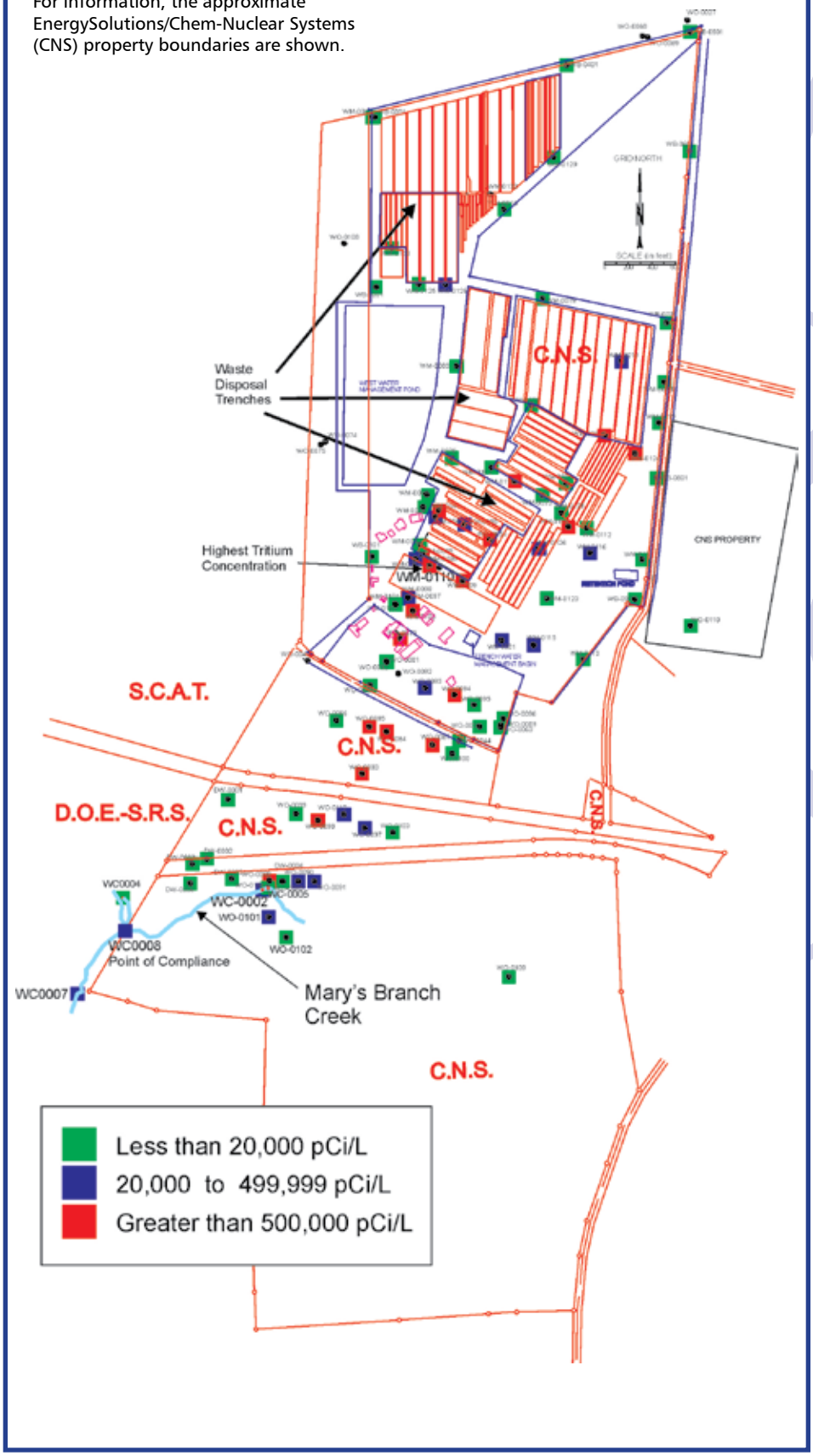
In May 2008, DHEC mailed a fact sheet to nearby residents and held a public availability session. The purpose of the fact sheet and availability session was to provide information on the groundwater and phytoremediation investigation (see articles on pages 3 and 4 for the groundwater and phytoremediation studies) and provide updated information about the VOCs. Chem-Nuclear began increased monitoring for VOCs in the last quarter of 2007. The latest quarterly sampling results (July 2008) show that there are three compounds that are present in the creek. They are Chloroform at 4.9 μg/L, 1,1-Dichloroethane at 1.6 μg/L, and 1,4,-Dioxane at 473 μg/L. No VOCs were detected at the compliance point (Well WC-0008 – see the map on the right) during the most recent quarterly sampling event.

Is it getting better or worse?

To track the changes in concentrations within the plume, DHEC requires Chem-Nuclear to submit an Annual Trending Report each year on whether the tritium plume is getting larger or smaller, and whether the levels of tritium are going up or down in certain wells. It is difficult to spot a trend from one year to the next so the trending report uses statistics to measure how the plume has changed over the past 5 years.

In the 2008 Annual Trending Report, 33 wells were evaluated along the boundary and axis of the plume. The data indicates that eight wells show an increasing trend in concentrations of tritium, 10 show a decreasing trend and 15 indicate no trend. The data also indicates that tritium concentrations at the point of compliance remain unchanged. A table of information will be provided at the community meeting. Tritium levels at the point of compliance are closely monitored by DHEC to ensure that they will not exceed regulatory limits.

MAP 1: Tritium Concentration Measured in Zone 2 and Mary's Branch Creek, Second Quarter 2008



Groundwater Study: Mary's Branch Creek

Current data shows that the boundaries of the groundwater plume are well defined. DHEC and Chem-Nuclear, however, are conducting a groundwater study to better define the plume characteristics in the specific area where the plume enters Mary's Branch Creek.

The study involves collecting groundwater samples along the creek on the north and south banks and in the center of the creek. The study will be done in two parts. The first part took place in July (during the summer when flow in the creek was low). The second part will involve taking creek flow measurements at the same location and begin in early 2009 (during the winter when flow in the creek will be high).

The map below shows the approximate locations where the samples for the first part of the study were collected along Mary's Branch Creek. About 220 total samples were collected. All of these samples were checked for tritium and many of them were checked for Volatile Organic Compounds (VOCs).

DHEC expects that a report on the sampling done in July 2008 will be available later this fall. In addition, DHEC hopes to have preliminary results available to present at the public meeting on November 6.

The purpose of the groundwater study is to: 1) better understand the precise locations where groundwater discharges to the creek; 2) determine the concentration range of tritium and VOCs at these locations; and 3) understand how water levels affect the movement of groundwater and surface water in the creek.

Sampling of Private Wells

Chem-Nuclear and DHEC have been sampling private wells surrounding the site since the early 1980s. Historically, sample results have shown that there is no contamination in the wells resulting from activities at the Chem-Nuclear Site. In response to concerns voiced by local citizens during the summer of 2007, Chem-Nuclear and DHEC sampled 45 additional private wells in the area near the site. Ten private well locations were added to the routine monitoring program and have been sampled on a quarterly schedule.

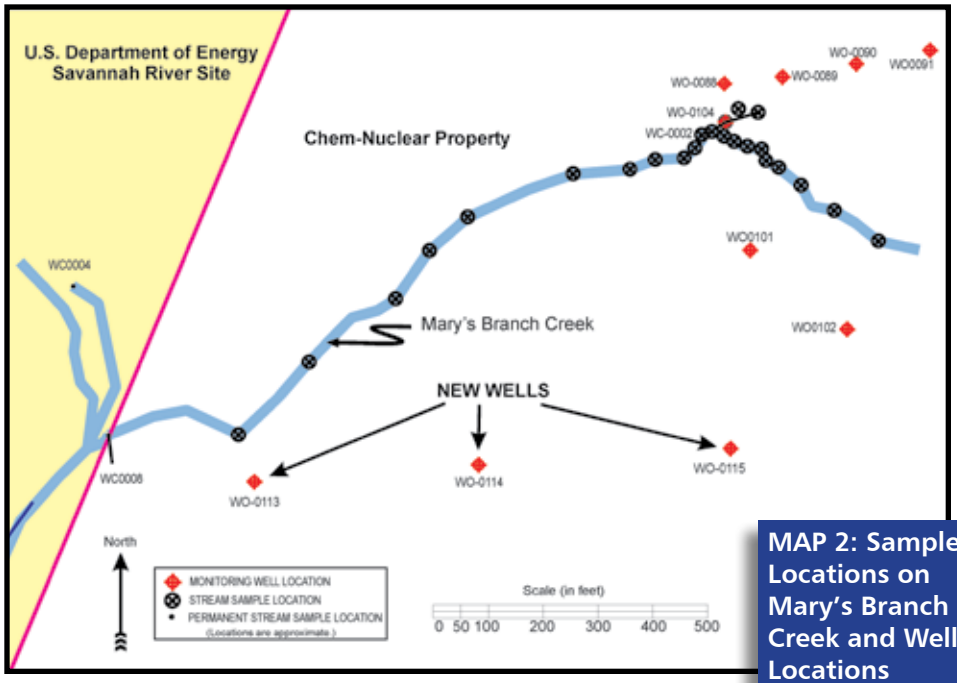
DHEC and Chem-Nuclear have sampled the additional private wells for three quarters since the original sampling began in the summer of 2007. DHEC is waiting on the results from the third quarter of 2008. The results for the first and second quarters show that none of the tritium levels found in private wells were greater than "background" levels (those found in the surrounding natural environment). Some levels of tritium found in private wells were below a level that could be accurately measured (called "non-detect"). Background levels in the surrounding natural environment are typically less than 800 pCi/L. The highest level found in any of the wells was 718 pCi/L. The levels that were found in private wells confirm that the tritium is not from CNS. These levels do not exceed the U.S. Environmental Protection Agency drinking water standard of 20,000 pCi/L for tritium.

DHEC may continue to sample private wells on an annual basis (once per year) after reviewing the results from four quarters of sampling.

Sampling at Mary's Branch Creek

Is groundwater from the Chem-Nuclear Site being captured by Mary's Branch Creek? Groundwater enters the creek from the north (on the disposal site side) and from the south. There are currently two wells on the south side of the creek that are checked for tritium. One of these wells shows higher concentrations of tritium at times of low groundwater levels. DHEC and Chem-Nuclear are installing three more wells on the south side of the creek. The approximate locations of the new wells are shown in the map below. Once installed, these wells will be sampled regularly for tritium and VOCs. The results of the sampling will help to show if and when groundwater passes under the creek.

Typically, the groundwater coming from the north side of the creek will flow into the creek. However, when there are drought conditions and the water table is low, the groundwater coming from the north side of the creek may pass under the creek. When this happens, the groundwater samples taken from Well WO-0101 will have higher levels of tritium than usual. During periods of normal water table levels, the tritium levels will go back down in this south side well.



MAP 2: Sample Locations on Mary's Branch Creek and Well Locations

Phytoremediation Study: Mary's Branch Creek

Mary's Branch Creek is located about 2,000 feet southwest from the Chem-Nuclear Site. It is a mostly groundwater-fed stream surrounded by a forest of a variety of hardwoods and pine trees. The valley containing Mary's Branch Creek is steep in places, but is relatively flat within about 25 feet on either side of the creek. The area receives about 46 inches of rain per year, but Mary's Branch Creek continues to flow even during periods of low rainfall because groundwater is the primary contributor to stream flow. The flow of water in Mary's Branch Creek is less than a foot deep in most locations and generally the creek is less than 15 feet wide.

What is phytoremediation?

Phytoremediation uses plants to clean up pollution in the environment. Plants can help clean up many kinds of pollution including metals, pesticides, explosives, oil and radioactivity. The plants also help to prevent wind, rain and groundwater from carrying pollution away from sites to other areas.

Above: *A USGS field team at Mary's Branch Creek install samplers for the phytoremediation study.*

Right: *Mary's Branch Creek*

What is transpiration?

Transpiration is the process of the taking up of water by plants (usually through the roots), the movement of water through plants and the loss of the water to the atmosphere through small openings on the underside of leaves called stomata. Transpiration is one of the processes that scientists rely on when phytoremediation is used to clean up contaminated groundwater.

2008 Update

DHEC is continuing to work with the U.S. Geological Survey (USGS) to study how existing trees in the area between the disposal site and Mary's Branch Creek may be taking up some contaminated groundwater before it gets to the creek. If the results of the study show this uptake is significant, DHEC may consider planting more trees in the area to enhance this natural process known as phytoremediation.

The study began in July 2008 and focused on trees located in the groundwater plume near the upstream reach of Mary's Branch Creek. The study involved collecting tree cores (from about 20 trees) and groundwater samples (about 10) in the area where tritium contamination is known to be entering the creek. Tree-core and water samples for tritium were analyzed at a USGS laboratory in Columbia. Transpiration (uptake of water through the tree trunk and the emission of water vapor from the leaves) is being measured in the same area.

The final report from USGS should be completed in time for DHEC to present results from the study in the Fall 2009 annual report.

Coming Soon! Plume Data Online

DHEC is in the process of making information about the groundwater plume at the Chem-Nuclear Site readily available to the community on its Web site. Using the Geographical Information System (GIS) software on the Web site, you will be able to view maps of the site showing the exact location of all the on-site and off-site wells and other sampling points. In addition, you will be able to click on each well to get more information about the well including the historical tritium and VOC levels. The database will be updated four times per year as new sampling results are available.

Visit **www.scdhec.gov/environment/lwm/** for more information. Then click on "Radioactive Waste" under "Quick Links."

Chem-Nuclear Site 'Closure'

What is "closure?"

The Chem-Nuclear Site is receiving less waste now that it is only open to the Atlantic Compact States (Connecticut, New Jersey and South Carolina). The site is continuing to operate and therefore is not "closing its gates;" however, Chem-Nuclear is beginning a regulatory process called "closure."

The closure process varies from one site to another and includes activities like cleaning and/or tearing down buildings, selling or disposing of equipment and tools that are no longer needed, and testing the soils for contaminants. For some sites, the goal of the closure process is to prepare the site to be used for another purpose. For the Chem-Nuclear Site, the goal of the closure process is to secure and stabilize the site.

The Chem-Nuclear Site closure process will be completed in two phases. Phase I started in July 2008 (when the site stopped accepting waste from all states except the Altantic Compact States) and is expected to last 15 months. Phase II will begin when the site stops accepting waste from the Atlantic Compact States. It is currently projected that Phase II will begin in 2038 and is expected to last one year. When the closure process (both Phase I and Phase II) is complete, DHEC will continue to be oversee the site for at least 100 years. (See the timeline below.)

Phase I Closure

There are many activities required in Phase I closure. All work is performed by Chem-Nuclear and verified by DHEC.

The main activities are:

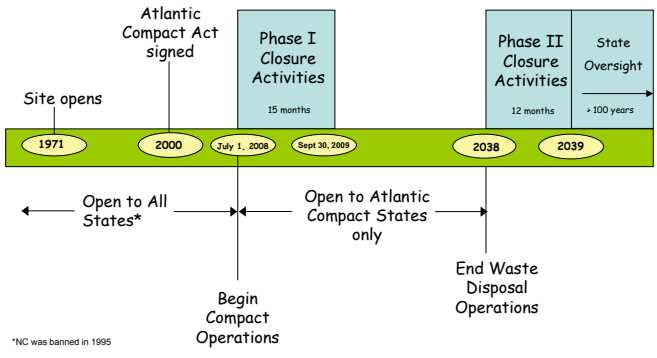
1. **BUILDING DECONTAMINATION AND DISMANTLING** – Five buildings, that are no longer needed, will be carefully taken apart (dismantled) and disposed of in on-site trenches. Some of the wood will be shipped off site to be burned at a regulated facility in Tennessee. Some parts of the buildings will be cleaned (decontaminated) as necessary to prevent the spread of radioactive dust during handling.
2. **REMOVAL OF EQUIPMENT AND TOOLS** – Clean items that are no longer needed will be reused elsewhere or recycled. Most contaminated items will be disposed of on site.
3. **ENHANCED CAP INSTALLATION** – Groups of trenches that have been filled with waste will be covered with an "enhanced cap." The cap is made of many layers of engineered materials and is designed to keep water from penetrating and coming in contact with the waste below it. An illustration of the cap materials and design is shown below. About 23 acres of disposal area will be "capped" as part of Phase I closure bringing the total to approximately 120 acres.
4. **SITE GRADING** – The land surface across the site will be graded (sloped) to direct rainwater into large ponds that will collect the water.
5. **SOIL SAMPLING** – The soil underneath buildings will be checked to make sure there is no contamination (radioactive materials). If contamination is found, it will be cleaned up according to regulatory requirements.
6. **TRENCH MARKER INSTALLATION** – The location of each trench will be marked with permanent granite markers (weighing about 300 pounds each) that will list the trench number, the length and width of the trench, the amount of radioactivity (Curies) in the trench and the date the trench was closed.

At the end of Phase I closure, all the filled trenches will be "capped," the excess buildings and equipment will be gone and the drainage systems and collection ponds for the entire site will be complete. Environmental monitoring and site maintenance will continue.

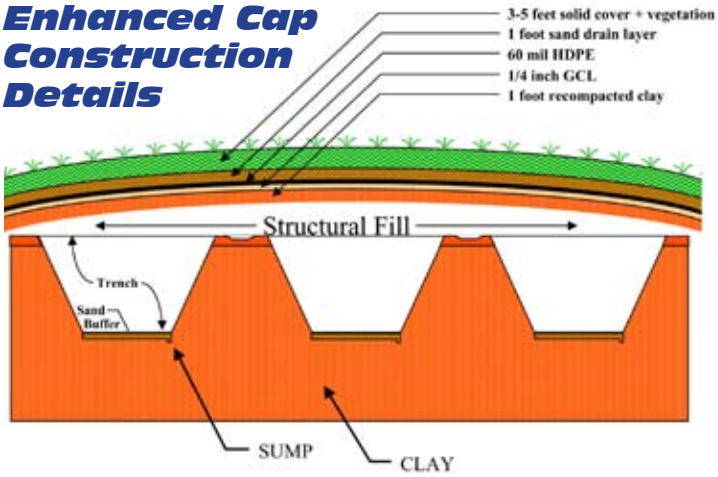
Phase II Closure

Phase II will involve some of these same activities for the trench areas that were filled after Phase I closure. Phase II will involve taking apart the remaining buildings. Additional activities – such as transferring records and control of the site to the State of South Carolina and setting up an unmanned security system including fences, lighting and posted signs – also will be part of Phase II.

Projected Timeline



Enhanced Cap Construction Details



The Atlantic Compact:
The Low-Level Radioactive Waste Compact System

How It All Started ...

In the early 1970s, there were six low-level radioactive waste (LLRW) disposal facilities operating throughout the United States. The operating facilities were in Maxey Flats, Kentucky; West Valley, New York; Sheffield, Illinois; Beatty, Nevada; Richland, Washington; and Barnwell, South Carolina [Chem-Nuclear Systems (CNS) Site]. By 1979, however, there were only three facilities that remained open – those in Washington, Nevada and South Carolina. The closure of three commercial disposal facilities resulted in increased volumes of waste for the three remaining sites. The governors from the states of the three remaining facilities voiced their concerns to Congress and received the following resolution found in the Congressional Record on May 19, 1980:

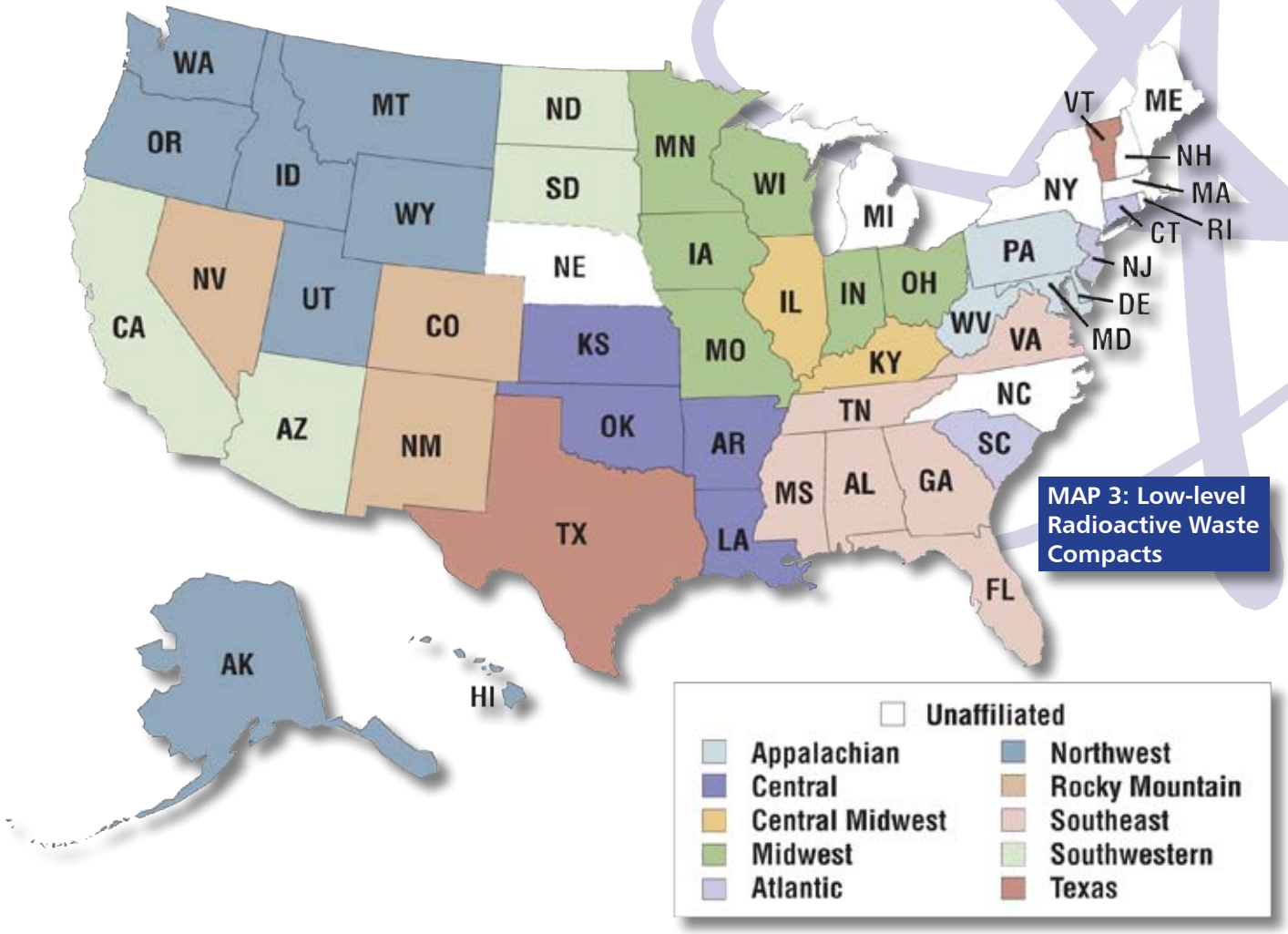
"The national policy of the U.S. on LLRW shall be that every State is responsible for the disposal of LLRW generated by non-defense related activities within its boundaries and that States are authorized to enter into interstate compacts, as necessary, for the purpose of carrying out this responsibility."

The resulting Low-Level Radioactive Waste Policy Act of 1980 encouraged states to join together in groups (interstate compacts) and agree to develop and/or operate a regional disposal facility.

The Atlantic Compact

South Carolina was initially affiliated with the Southeast Compact, but withdrew in July 1995 because North Carolina – the next designated host state – failed to site (find a location for) a new facility as required. In 2000, South Carolina joined Connecticut and New Jersey as the third member of the Atlantic Compact (formerly the Northeast Compact). See MAP 3 below.

The Atlantic Compact Act provided a schedule to reduce the waste volume receipts at the Chem-Nuclear Site from Fiscal Year 2001 to 2008 as shown in CHART 2.



MAP 3: Low-level Radioactive Waste Compacts

Current LLRW Disposal Facilities

Currently, there are three operating LLRW disposal facilities. The Hanford Facility in Washington, operated by US Ecology, disposes of LLRW generated within the Northwest and Rocky Mountain Compacts. The Clive Facility in Utah, operated by EnergySolutions, is the nation's largest LLRW disposal facility and began accepting LLRW in 2000. The Chem-Nuclear Site in South Carolina operated by EnergySolutions disposes of LLRW generated within the Atlantic Compact.

A new facility has been sited in Texas and is currently going through the licensing process. The operator will be Waste Control Specialists. (See TABLE 1.)

2008 Update

Since July 1, 2008, the Chem-Nuclear Site only accepts LLRW generated from the three member states of the Atlantic Compact – Connecticut, New Jersey and South Carolina. The site received two shipments in July, three shipments in August and two in September. As a comparison, the site received 53 shipments of radioactive waste for disposal in June of 2008.

CHART 1 shows how the volume of waste received and disposed of at the Chem-Nuclear Site has changed since waste was first accepted in 1971. In the 1980s, the waste volume averaged about 1 million cubic feet per year.

The Atlantic Compact Act required the volume of waste to be ramped down from 160,000 cubic feet in Fiscal Year 2001 to 35,000 cubic feet in Fiscal Year 2008. (The South Carolina fiscal year is from July 1 to June 30.) The average waste volume since July 1, 2008 has been less than 300 cubic feet per month.

Even with the lower volumes of radioactive wastes being shipped to the Chem-Nuclear Site for disposal, waste will continue to be accepted year round from the Atlantic Compact states. DHEC will continue to maintain an on-site inspector to provide compliance inspections for all waste shipments made to the site.

TABLE 1: Current LLRW Disposal Facilities

Facility Location	Operated By	Compact Region	Accepts Waste From
Hanford, Washington	US Ecology	Northwest*	Northwest and Rocky Mountain Compacts
Clive, Utah	EnergySolutions	Northwest	Nation
Barnwell, SC	EnergySolutions[1]	Atlantic	Atlantic Compact
Near Andrews, Texas[2]	Waste Control Specialists (WCS)	Texas	Texas Compact

1 Chem-Nuclear is owned by EnergySolutions. The property itself is owned by the State of South Carolina.

2 Facility received a draft license in August 2008 and therefore is not currently operational. A Public Meeting was held September 8, 2008 in Andrews, Texas.

* Designated Regional Disposal Facility

CHART 1: Waste Disposal Volume History 1971 to 2000

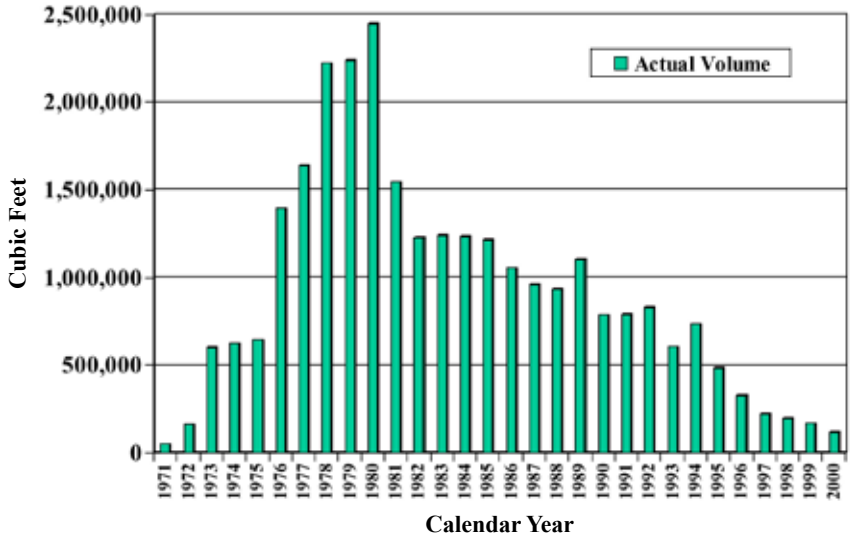
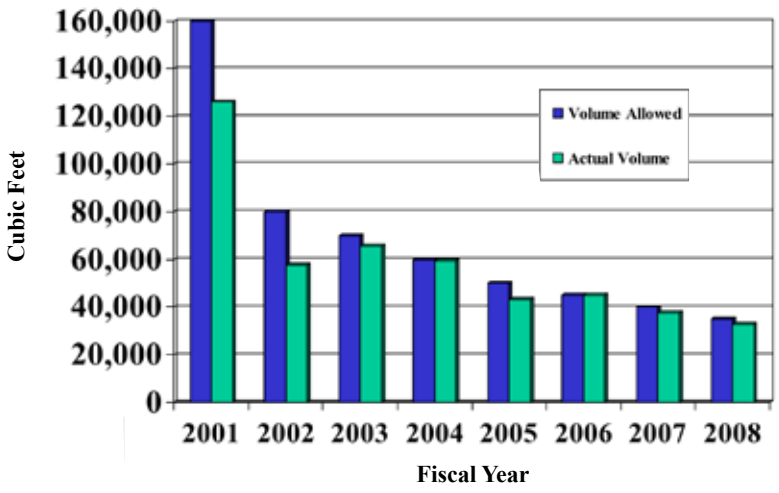


CHART 2: Waste Disposal Volume History Atlantic Compact Years, 2001 to 2008



We want your input.

DHEC is committed to keeping residents informed and updated about activities at the Chem-Nuclear Site. DHEC will do this through annual newsletters and/or community meetings. This newsletter and community meeting on Thursday, November 6 are the first of these annual updates.

DHEC wants to hear from you about the content and format of this information and what improvements you think that we could make in future updates. Please share your thoughts with the DHEC staff at the community meeting or contact them by telephone or e-mail. A list of contacts is provided on the right.

If you would like to respond in writing, please use the space below. Then, mail this page to the **Infectious and Radioactive Waste Management Section, S.C. DHEC, 2600 Bull Street, Columbia, SC 29201**. Thank you.

DHEC Contacts

If you have any questions about the Chem-Nuclear Site, please contact the DHEC staff listed below.

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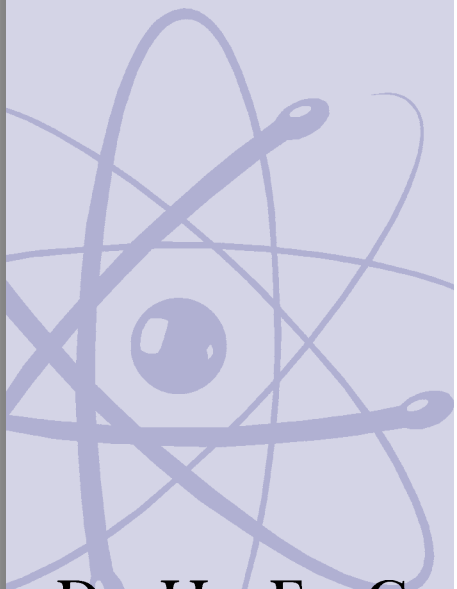

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